APSYN420D Specification 1.4 (May 2014)

0.01 - 20.0 GHz Low Phase Noise Synthesizer

Introduction

The APSYN420D is a wideband low phase-noise synthesizer operating from 0.01 to 20 GHz. The nominal output power is +16 dBm.

The module has a mili-Hz frequency resolution uses a high-stability internal reference. The internal reference can be phase-locked to a user-settable external reference. For highest phase coherence, multiple APSYN420Bs can be cascaded with just one master reference clock.

The APSYN420 offers dedicated sweeping capabilities and wideband frequency modulation as well as narrow pulse modulation.

The module has a USB and LAN interface and can be controlled using SCPI 1999 command set. Operated with an external 6V DC supply, it consumes less than 10 watts.

Signal Specifications

The specifications in the following pages describe the warranted performance of the signal generator for 23 ± 10 °C after a 30 minute warm-up period. Typical specifications describe expected, but not warranted performance. Min and Max specifications are warranted.

Parameter	Min.	Typ.	Max.	Note
Frequency range	0.01 GHz		20 GHz	
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Settling time		20 µs	100 µs	
Frequency update rate List/Sweep mode		200 µs 100 µs		time from receipt of SCPI command
SSB Phase noise at 10 GHz				
at 1 kHz from carrier		-98 dBc/Hz		
at 20 kHz from carrier		-108 dBc/Hz		
Wideband noise		-150 dBc/ Hz		
Output power level				(see also plot)
		+16 dBm		
Reverse Power Protection				
DC Voltage		7 V		
RF power			20 dBm	
Output impedance VSWR		50 Ω 1.8		
Spectral purity Output harmonics Sub-harmonics		 -15 dBc -75 dBc	 -60 dBc	
Non-harmonic spurious		-75 dBc	-60 dBc	

Sweeping Capability

Sweeps can be performed with combined internal or external AM/FM/PM/pulse modulation running. With modulation enabled, the minimum step time increases to 2 ms.

Parameter	Min.	Typ.	Max.	Note
Frequency sweep Sweep type: linear, logarithmic, random				
Step time (t_{step})	200 µs			
Dwell time (t_{dwell})	50 µs			
Off-time (incl. transient time) (t_{off})	0		t_{step}	
Frequency Chirps (linear ramp, up/down)				
Bandwidth		10%		
Dwell time (t_{dwell})	10 ns		tbd	
Number of frequencies			65'000	

Notes:

Frequency Reference

Reference frequency input **Max. phase coherent mode**	1 MHz	100 MHz	250 MHz	
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			±1.0 ppm	
Reference input impedance		50 Ohms		
Internal Reference Output Frequency		10/100 MHz		
Output Power		>0 dBm 50 Ohms		
Temperature stability (0 to 50 degC)			±100 ppb	
Aging 1st year		0.5 ppm		
Aging per day (after 30days operations)			5 ppb	
Warm-Up time		5 min		

Notes:

Modulation Capabilities

Parameter	Min.	Typ.	Max.	Note
Frequency modulation (internal) Maximum Frequency deviation (peak)	N · 500 MHz			*1.25 GHz to 2.5 GHz (N=0.125)* *2.5 GHz to 5 GHz (N=0.25)* *5 GHz to 10 GHz (N=0.5)* *> 10 GHz to 20 GHz (N=1)*
Modulation rate	DC		800 kHz	> -3dB frequency response
Total harmonic distortion	< 1%			1 kHz rate & 2 N · 1 MHz deviation
Phase modulation (internal) Phase deviation (peak)	0		N·100 rad	
Modulation rate	DC		800 kHz	> -3dB frequency response
Total harmonic distortion	< 1%			1 kHz rate & 2 N x 100 rad deviation
Pulse Modulation (int & ext) On/off ratio		Frequency dependant		**APSYN420B only**
Repetition frequency	DC		10 MHz	
Pulse width	30 ns			ALC hold
Pulse rise/fall time		7 ns		
Pulse trains length (pulses)	2		4192	
Pulse width	30 ns		100 µs	(internal generator)
Pulse resolution		15 ns		(internal generator)
Polarity		selectable		
External input amplitude		1 V TTL		AC DC

Notes:

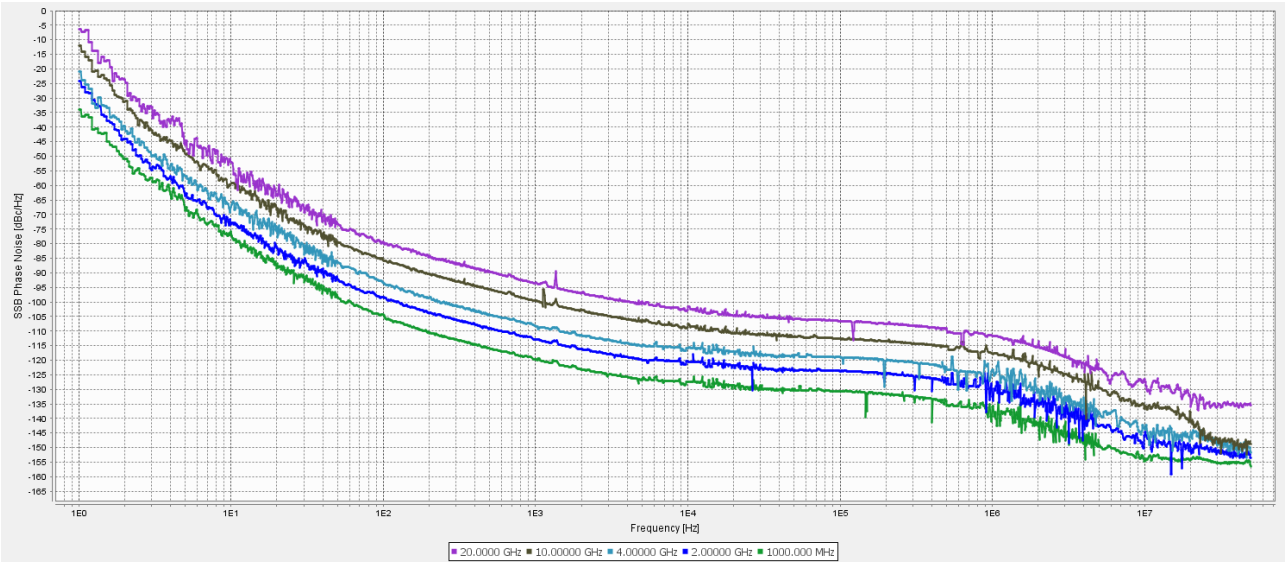
Trigger (TRIG IN)

Input is TRIG IN at front panel

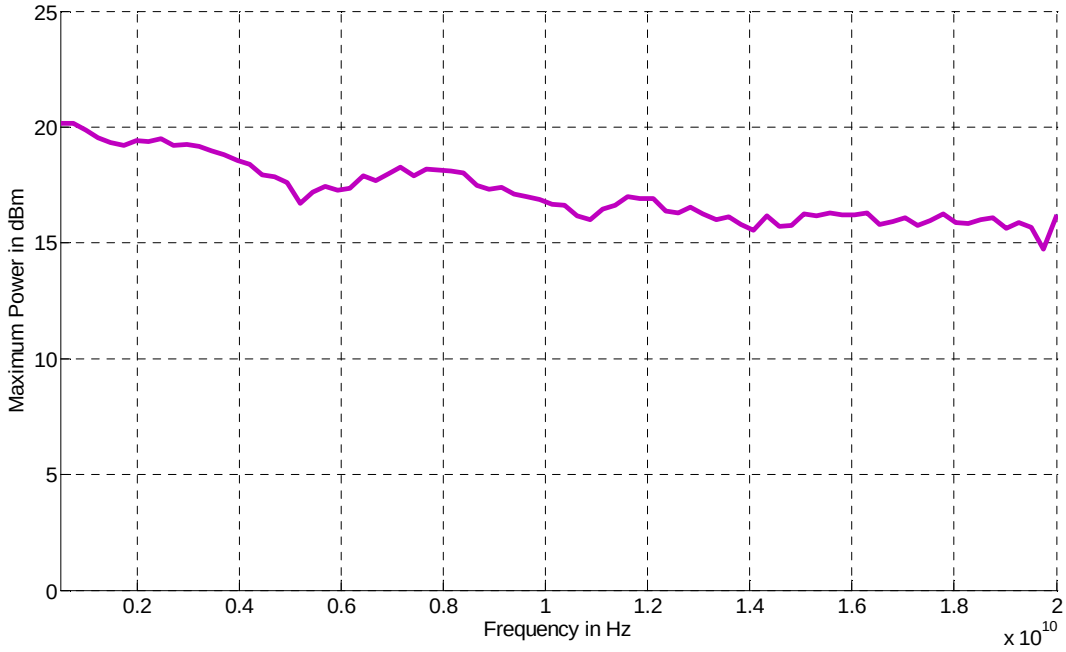
Parameter	Min.	Typ.	Max.	Note
Trigger Types	**Continuous, single (point), gated, gated direction**			
Trigger Source	**external, bus (LAN, USB)**			
Trigger Modes	**Continuous free run, trigger and run, reset and run**			
Trigger latency		tbd		
Trigger uncertainty		5 µs		
External Trigger delay	50 µs		40 s	
External Delay Resolution		15 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

Typical performance curves

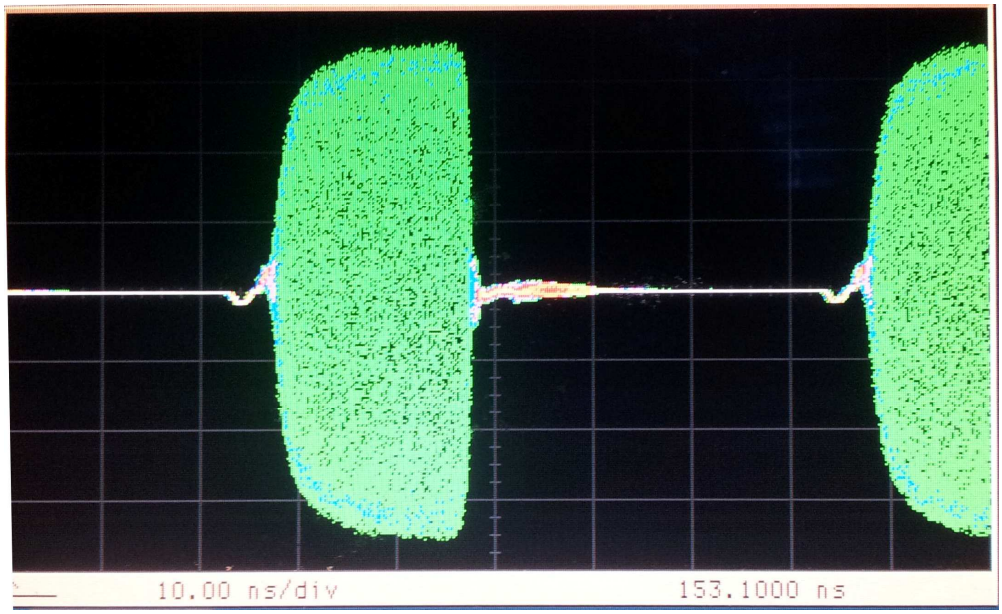
Phase Noise Performance



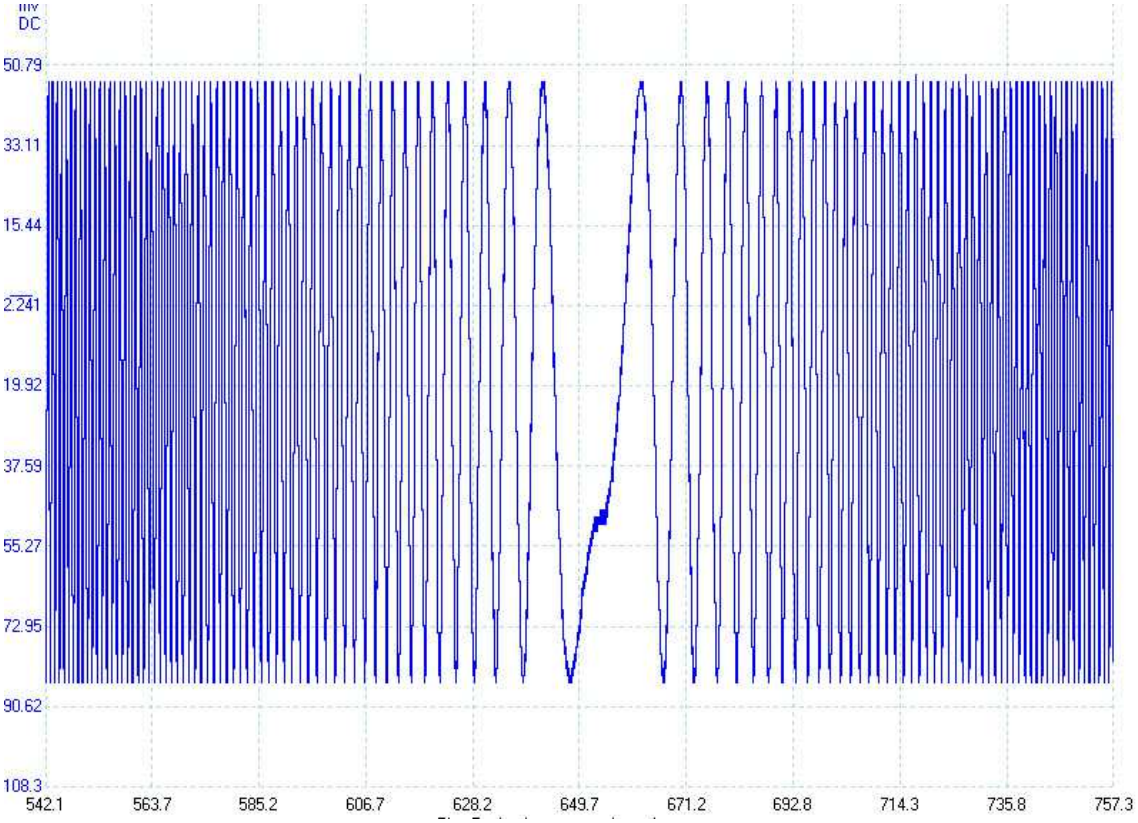
Output Power 0.5 to 20 GHz (APSYN420C)



Pulse Modulation (20 ns width, 100 ns period)



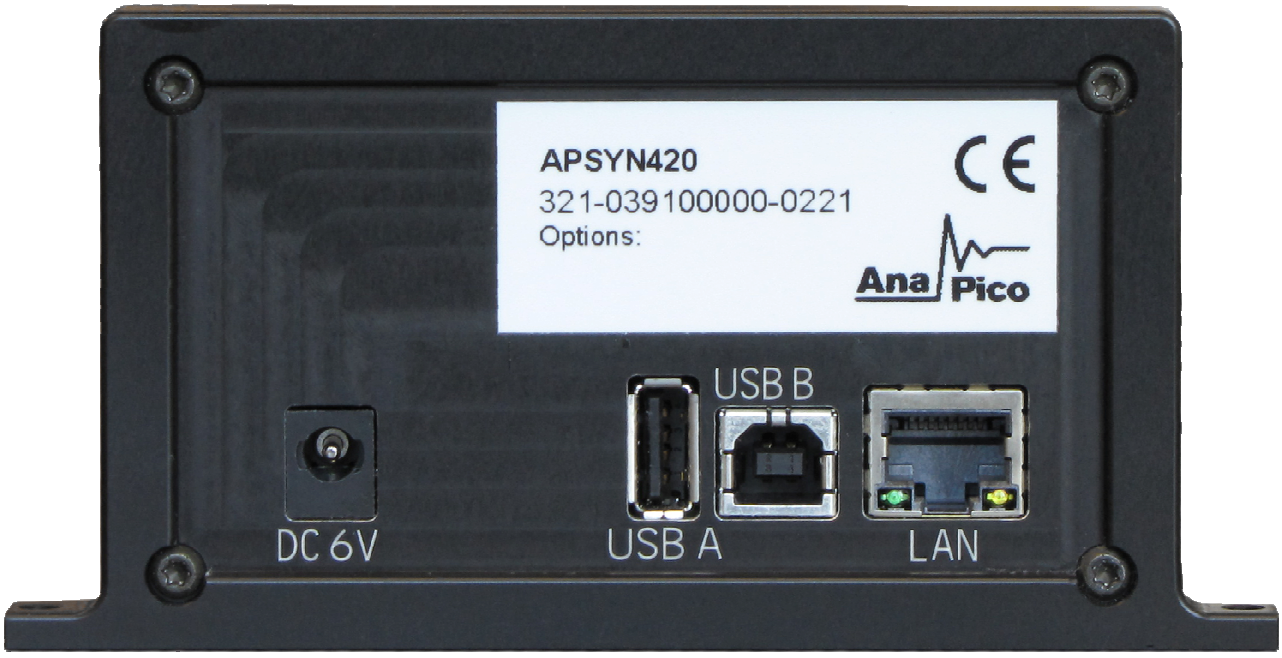
Chirp (phase continuous, 1 GHz bandwidth)



Connectors

Front panel:

Rear panel:



General Characteristics

Remote programming interfaces
Ethernet 100BaseT LAN interface,
USB 2.0 host & device
GPIB (IEEE-488.2,1987) with listen and talk (optional)
Control language SCPI Version 1999.0

Power requirements 6 VDC; 10 W maximum
Mains adapter supplied: 100-240 VAC in/ 6V 2.5A DC out
Operating temperature range 0 to 40 °C
Storage temperature range –40 to 70 °C
Operating and storage altitude up to 15,000 feet

CE notice
Safety/EMC complies with applicable Safety and EMC regulations and directives.

Weight ≤ 0.5 kg (2 lbs) net
Dimensions 21 x 10.5 x 6 cm

Document History

Version/Status	Date	Author		Notes
V10	2011-03-01	jk		first release
V11	2011-08-01	jk		Reference input lock range adjusted; Reverse power protection data added
V12	2012-10-30	jk		Pulse Modulation, Frequency range
V121	2012-12-3	jk		Distinguish A and B
V122	2013-1-20	jk		Trigger added
V123	2013-1-20	jk		Measurements added
V124	2013-3-4	jk		Typ. Output Power corrected
V130	2013-12-2	jk		APSYN420C data added
V140	2014-5-28	jk		APSYN420D data added